



# *Information Technology Laboratory*



Building Trust and  
Confidence in IT  
through Standards,  
Measurements, and  
Technology

**NIST**

**National Institute of Standards and Technology**  
Technology Administration, U.S. Department of Commerce

**B**uilding trust and confidence in information technology is critical to the development of secure and reliable systems and applications for a range of important functions, such as ensuring the security of our information assets, protecting our critical infrastructures, or enabling ad hoc communications for emergency first responders. Increasingly, the activities of government and industry rely on IT, most notably, e-government. With today's systems growing ever more complex, the challenge is to provide the necessary measures of trust and confidence.



Through measurement science and standards, the Information Technology Laboratory (ITL), part of the National Institute of Standards and Technology, is responding to the challenge. Working with industry,

government, academia, and standards organizations, ITL is taking a leading role in making IT more usable, more secure, more scalable, and more interoperable than it is today.

## FOUNDATION RESEARCH AREAS

ITL's cutting-edge research is organized around core areas reflecting our wide-ranging expertise and the needs of our customers—U.S. industry, federal agencies, academia, and research organizations.

### Information Security

ITL's security research encompasses four broad areas—cryptographic standards and applications, security management and guidelines, security testing and metrics, and security of emerging technologies. For many years, ITL has been mandated by legislation to provide computer security standards and guidelines to federal agencies for the protection of sensitive unclassified information in their IT systems and networks.

ITL strives to provide federal agencies, industry, and the public with a proven set of IT security services based on sound testing methodologies and test metrics. Our security testing program includes the National Information Assurance Partnership and cryptographic security testing via the Cryptographic Module Validation Program. Through our growing toolkit of standardized cryptographic algorithms and security techniques and protocols, ITL is enabling more efficient, secure, and interoperable information systems and electronic commerce.

**Web site:** [csrc.nist.gov/](http://csrc.nist.gov/)





## Information Integration

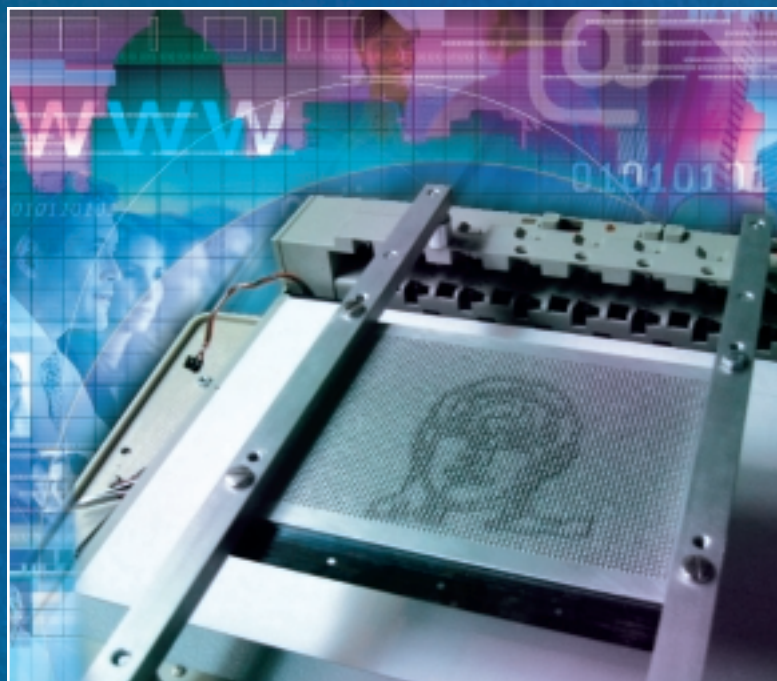
ITL is actively conducting research in the rapidly growing area of converging digital information with increasingly diverse digital systems, such as digital TV and DVD. In response to the needs of industry for uniform and reliable writable disc media, we are developing standards, test methodologies, and guidelines. In cooperation with the National Federation of the Blind, ITL built the NIST Refreshable Tactile Graphic Display, which allows blind and visually impaired users to see images through touch. ITL is also developing interoperability guidelines for rights management of digital content and file formats, along with metrics and guidelines for architectures ensuring efficient delivery and transport of digital content.

**Web site:** [www.itl.nist.gov/div895](http://www.itl.nist.gov/div895)

## Information Access

ITL develops the measurements and standards to advance technologies used in accessing unstructured digital multimedia information—text, Web pages, voice, video, and graphics. We are involved in MPEG, JPEG, and Web3D standards activities and have created an MPEG-7 interoperability testbed. Within the broad field of human language technology, ITL develops and applies metrics and testing to advance the state of the art in human language processing—document and text searching and understanding, speech recognition and understanding, and speaker recognition. Another major research program is aimed at improving the usability of interactive systems, with a focus on IT accessibility and usability engineering.

**Web site:** [www.itl.nist.gov/iad](http://www.itl.nist.gov/iad)



## Software Testing

ITL has major software research programs in healthcare, electronic commerce, computer forensics, and software testing itself. We develop tools and techniques to improve the development of software specifications, tests, and quality. In the area of healthcare, ITL is working closely with the industry to help it utilize IT more effectively by developing standards and measurements, such as security guidance for healthcare systems and mobility protocols for wireless and portable information devices.

**Web site:** [www.itl.nist.gov/div897](http://www.itl.nist.gov/div897)

### ◆ Electronic Commerce

Electronic commerce solutions are being built using XML technologies as building blocks. ITL is working to improve the quality of XML-related software through the development of standards, conformance testing, and quality assurance practices with organizations such as the World Wide Web Consortium. Conformance testing improves software implementation and interoperability.



## ◆ Computer Forensics

In partnership with NIST's Office of Law Enforcement Standards and the National Institute of Justice, ITL has research under way in computer forensics, providing valuable resources to the law enforcement community. Our program has two components: the National Software Reference Library (NSRL) and Computer Forensics Tool Testing (CFTT). A special database of commercial software files, the NSRL reduces the amount of time spent looking at computer files seized during an investigation through an automated identification of known untampered software. The goal of our CFTT project is to provide a measure of assurance that computer forensics tools perform as expected through the development of specifications and test methodologies.

**Web site:** [www.nsrl.nist.gov](http://www.nsrl.nist.gov) and [www.cftt.nist.gov](http://www.cftt.nist.gov)

## Advanced Networking

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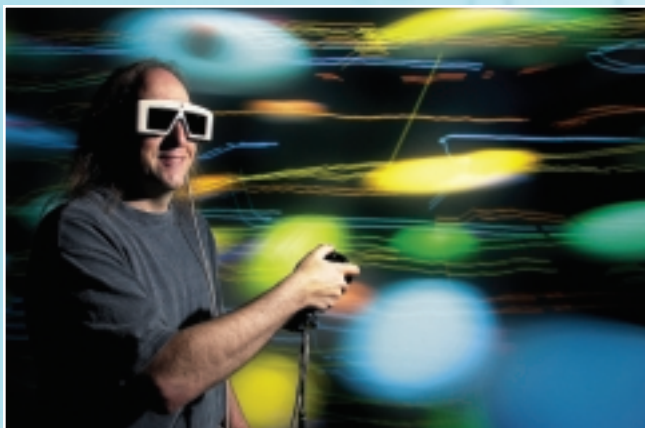
ITL works with the communications and networking industries to expedite the development and deployment of technologies for the Internet and optical and wireless networks. Our research programs focus on the development of agile switching infrastructure integrating the Internet and optical networks, the development and deployment of techniques for Internet security and infrastructure protection, and the evaluation of networking protocols for pervasive computing and wireless communications, including service discovery, wireless personal area networks, and wireless ad hoc networks.

**Web site:** [www.antd.nist.gov](http://www.antd.nist.gov)

## Mathematics and Computational Science

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ITL has ongoing research programs in applied mathematics, high performance computing and visualization, and mathematical software. The applied mathematics program focuses on the development of models, methods, and tools applicable to problems of national interest—atomic physics, bioinformatics,



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electromagnetics, materials science, manufacturing, and construction engineering. We are developing the Digital Library of Mathematical Functions, an interactive Web-based resource on the special functions of applied mathematics, in collaboration with other NIST laboratories and the National Science Foundation. Other research includes the development of tools and techniques for high performance parallel and distributed computing and the development, measurement, and standardization of general-purpose mathematical software tools.

**Web site:** [math.nist.gov](http://math.nist.gov)

## Statistical Engineering

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Helping to break new scientific ground, Statistical Engineering plays an important collaborative role in NIST research, providing optimal experiment design, statistical modeling, and data analysis for measurement processes in physical science, engineering, and IT. ITL statisticians continue to expand fundamental statistical theory necessary for the application of statistics to metrology, such as specialized Bayesian methods.

In collaboration with International SEMATECH, a consortium of major semiconductor companies, ITL published the first online edition of a highly popular reference guide for engineers and scientists, the ***e-Handbook of Statistical Methods*** ([www.itl.nist.gov/div898/handbook/](http://www.itl.nist.gov/div898/handbook/)).

**Web site:** [www.itl.nist.gov/div898](http://www.itl.nist.gov/div898)

## INITIATIVES IN THE NATIONAL INTEREST

In addition to our core programs, we have identified four research areas relating to the nation's security and the future of computing, where we can apply the many resources of our laboratory.



### Critical Infrastructure Protection

Consistent with our mission and long-standing information security responsibilities, ITL is developing standards and testing programs to help ensure the security of our nation's critical infrastructure. Through these programs, we are helping IT vendors build products that will better protect information and improve security. These improved products, in turn, enhance the security of the nation's communications and information-processing backbone. A copy of our brochure, ***Critical Infrastructure Protection***, is available on our Web site ([www.itl.nist.gov](http://www.itl.nist.gov)).

### Biometrics

ITL's in-depth research in biometrics covers a number of standards and technological efforts. Long active in the national and international standards arena, ITL has been leading the effort to adopt biometric interoperability and data interchange standards. Homeland security legislation—the USA Patriot Act of 2001 and

the Enhanced Border Security and Visa Entry Reform Act—mandates ITL's research in identification and verification technologies, with the goal of enhanced border security. ITL has extensive experience in automating fingerprint matching systems and in evaluating facial recognition systems. Expanding our reach to industry, academia, and federal, state, and local government, ITL cochairs the Biometric Consortium with the National Security Agency, which includes cosponsoring the annual Biometrics Consortium Conference.

**Web site:** [www.nist.gov/biometrics](http://www.nist.gov/biometrics)

### Pervasive Computing

ITL's pervasive computing initiative focuses on measurement, standards, integration, and interoperability of intelligent, interactive environments embedded with computers, information appliances, portable devices, and multimodal sensors. A natural fit for ITL, this initiative builds on our robust programs in human-computer interaction, such as speech and visual recognition and tracking, sophisticated information access from multimedia databases, and extensive information presentation capabilities, as well as our work in dynamic networking, wireless networking, software testing, and security. ITL is assisting industry in the development of standard specifications for pervasive computing devices, along with validating protocols that will enable the devices and conducting performance evaluations of the technologies.

**Web site:** [www.itl.nist.gov/pervasivecomputing.html](http://www.itl.nist.gov/pervasivecomputing.html)

#### ◆ Smart Spaces

One important aspect of our pervasive computing initiative is the advancement of technologies for smart spaces—work environments offering unprecedented levels of access to information and assistance from computers. Our modular testbed enables the research community to bring together next-generation technologies for integration and performance testing in a vendor-neutral environment.

**Web site:** [www.nist.gov/smartspace](http://www.nist.gov/smartspace)



## Quantum Information

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NIST's quantum information program was initiated in response to the confluence of computer science and quantum physics. The goal of the program is to understand the implications of the use of quantum states of matter to represent, process, and communicate information, and to begin to develop the new IT infrastructure necessary to support it. ITL is developing a quantum communication testbed facility for technology assessment and integration. We are also working on fundamental problems of quantum computation at all scales—from the modeling of physical realizations of quantum bits (qubits) to architectural concepts for quantum computers and the development of quantum algorithms.

**Web site:** [math.nist.gov/quantum](http://math.nist.gov/quantum)

## EMPLOYMENT AND RESEARCH OPPORTUNITIES AT ITL

### Employment

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ITL employs a highly diverse workforce of 250 scientists, engineers, technicians, and support and administrative personnel. Our research and operations facilities are located at Gaithersburg, Maryland, and Boulder, Colorado. For employment information, visit our Web site ([www.itl.nist.gov](http://www.itl.nist.gov)) and select *Opportunities at ITL*.

### Postdoctoral Research Associateships

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In cooperation with the National Research Council, NIST offers a number of two-year fellowships at the postdoctoral level. This program provides promising scientists and engineers the opportunity to pursue concentrated research in association with members of NIST's professional staff. The research associate is a resident researcher and temporary employee of NIST. Program and application information can be found at the Web site: [national-academies.org/rap](http://national-academies.org/rap).

## NIST/NIH Postdoctoral Fellowships

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A Joint Associateship Program between NIST and the National Institutes of Health (NIH) is now in place. The program is intended to introduce postdoctoral scientists to interdisciplinary research in both the biological and physical sciences. The associates will be co-mentored by one NIH and one NIST advisor, and will be expected to spend equal time on each campus over the two-year appointment. Candidates should apply through the National Research Council Research Associateship Program. More information can be found on the Web at: [national-academies.org/rap](http://national-academies.org/rap).

## Summer Undergraduate Research Fellowships

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In partnership with the National Science Foundation, NIST sponsors the Summer Undergraduate Research Fellowship (SURF) program annually. This program gives college students an outstanding opportunity to participate in NIST research projects with world-



recognized scientists. ITL is part of the larger program involving over 100 students at all the NIST laboratories. Students apply through their universities and the successful candidates receive paid travel to NIST,

housing, and a stipend. Application information and the SURF video can be found at:

[www.surf.nist.gov/surf2.htm](http://www.surf.nist.gov/surf2.htm).

## ANY QUESTIONS?

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Please send us an email: [itlab@nist.gov](mailto:itlab@nist.gov)